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Research Article

Inguinal Hernias in Adults: Epidemiological, Clinical and Therapeutic Aspects in the City of Douala

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Abstract

Background: Inguinal hernia is defined as the subcutaneous passage of a portion of the peritoneum containing abdominal viscera through the inguinal canal or directly through the abdominal wall. Its diagnosis is essentially clinical and strangulation is the most important of complications. Many surgical techniques have been described update. The aim of the present study was to highlight the epidemiological, clinical and therapeutic aspects of inguinal hernias in adults in Douala city.

Methodology: we conducted a retrospective study from January 01, 2010 to December 31, 2019. The study concerned medical records of patients aged from 18 and above, who were followed and or operated for inguinal hernia in the surgical wards of five hospitals in Douala city. Files with no content of: age, sex, type of hernia and the therapeutic method used have been excluded in the study. Variables were recorded on data collection sheets. Data were analysed using the software Sphinx plus² version 5.0.

Results: One thousand and twenty-four cases answered the inclusion criteria (925 males and 99 females). The mean age was 45.6 years (in-between: 18-94). Labourers category were about 56.4% of the cases (n = 578). 84.0% of cases (n=865) were simple

hernia, 7.0% of cases (n=74) were recurrences and 16.0% of cases (n=159) were complications. Strangulation with 85.5% of cases (n=136) was the most common complication. The factors in relation to these complications were the length progression of the hernia and patients professions. The predominant site of the hernia was the right side with 53.9% of cases of simple hernia and 65.2% of cases of complicated hernia. The diagnosis was clinical in 99.0% of cases and ultrasound (10 cases) was the only imaging test used for cases with doubtful diagnosis. Therapeutically the most widely used non-prosthetic treatment was that of Bassini in 47.8% of cases with simple hernias and in 46.7% of cases with complicated hernias. Lichtenstein technique was the most used prosthetic treatment with 90.5% of cases of simple hernias and 100% of cases of complicated hernias. The hernia was mainly through the external oblique in 66.0% of simple hernias and 76.9% of complicated hernias. Bowel resection and anastomosis were performed in 43 (27.0%) patients with intestinal necrosis. Recurrent hernia was mostly treated by the Shouldice technique in 25 cases (33.8%). The mean length of hospital stay was 3 to 4 days. The mortality and morbidity rate were respectively null and 1.4 (n=12) for simple hernias and 6.2 (n=10) for complicated hernias. The factors identified in relation to this morbidity were sex and the length of hospital stay.

Conclusion: inguinal hernia was the most common hernia of the abdominal wall (85.4%). It was predominant in the male sex (90.0%) and mostly present on the right side. Bassini surgical repair was the most used operating technique. Prosthetic cures (gold standard of the surgical management) were little or not well practiced in our setting and could be a tool to improve needed results.

Keywords: Inguinal hernia; Epidemiology; Clinic; Hernia repair; Complications; Cameroon

1. Introduction

An inguinal hernia is defined as the passage under the skin of a portion of the peritoneum possibly containing abdominal viscera through the inguinal canal or directly through the abdominal muscles [1]. Almost 95% of groin hernias are inguinal hernias. The remaining 5% concern crural hernias. They mainly affect the male subject between 20 and 60 years. Ten percent of digestive surgery procedures are cures for inguinal hernias [2]. A distinction is made between direct inguinal hernia, external oblique hernia, pantal hernia and inguinoscrotal hernia. Worldwide, there are more than 20 million inguinal hernia cures per year [3]. In the United States of America (USA), 800,000 cures for inguinal hernias are performed each year [3]. In France inguinal hernias represent 17.2% of all surgeries [4]. Recent population studies in sub-Saharan Africa have found a prevalence of adult inguinal hernias of 7-13% with a predominance of inguinoscrotal hernias [5]. In Senegal, a study conducted by Konaté et al found a prevalence of 15.3 of inguinal hernias [6]. In northern Ghana, the current rate of inguinal hernia treatment is 123 per 100,000 population [5]. In Benin, a study conducted by Olroy-Togbé et al found that inguinal hernia was the most common parietal hernia, ie 79%. In the same study, pure inguinal hernia represented 63% and inguinoscrotal hernia 37%. The majority of patients were male, i.e. 96% and 2 times out of 3 (68%) are on the right [7]. In Mali, inguinal hernia occupies the 2nd place in visceral surgical interventions after appendicitis, i.e. 30.22% of cases [8]. The diagnosis of inguinal hernia is primarily clinical. In doubtful cases (pain without swelling, obese patient, etc.) additional examinations, especially ultrasound and rarely CT scan [9] can be used. Hernial strangulation is the most serious complication and constitutes a diagnostic and therapeutic emergency. It is linked to a mortality of around 10% [10]. A 2017 study by Syed et al. of 40 cases of complicated hernias found that the most common complication was irreducibility (45%), followed by strangulation (25%). The direct inguinal

hernia is the most represented, followed by the indirect hernia then by the pantal hernia [11]. A study of 34 cases in Niger found that 50% of strangulated hernias lead to intestinal necrosis with a need for resection [12]. Several techniques for repairing inguinal hernias have been described to date. The oldest are herniorrhaphy, followed by prosthetic cures and then laparoscopic hernia repairs. Non-prosthetic treatments (Bassini, Shouldice, Mac Vay, etc.) present a significant risk of recurrence [5]. The tension-free technique according to Lichtenstein allows adequate prosthetic reinforcement and a low recurrence rate [13]. The laparoscopic approach offers advantages in terms of operating time, aesthetic results, wall complications, postoperative comfort and early return to professional activity [14]. Today groin surgery can be performed on an outpatient basis. Thus in Algeria in 2018, a study conducted by Sahli et al showed that outpatient surgery remains a challenge for practitioners in underdeveloped countries whose organizational system remains precarious [15]. In Cameroon, inguinal hernias in adults are a common pathology. They account for 91% of groin hernias and are predominant in men with a sex ratio of 8/1 [16]. Farmers are exposed to it and run a high risk of complications according to a study by Nde et al [17]. MAYDL's hernia, a rare form (less than 2%) of strangulated inguinal hernia was described in a study conducted by Ngowe et al in 2014 [18]. The practice of the Lichtenstein technique, associated with a reduced hospital stay and a low rate of recurrence is recommended [4]. Its indications are codified by the NYHUS classification. Laparoscopic pre-peritoneal trans-abdominal hernia repair (TAPP) is an adequate technique nowadays [19]. A review of the African literature carried out by Ohene-Yeboah et al in 2012 clearly showed insufficient data on inguinal hernias [20]. Therefore, we propose to conduct a study in Cameroon, particularly in the city of Douala, looking for the epidemiological, clinical and therapeutic aspects of inguinal hernias in adults.

2. Results

2.1 Epidemiology

2.1.1 Frequency

We identified all the hernias of the abdominal wall. Inguinal hernia was the most represented with 1892 cases (85.4%), followed by umbilical hernia 170 cases (7.7%) and then white line hernia 73 cases (3.3%).

Abdominal wall hernias	Effective	Percentages(%)
Inguinal hernias	1892	85.4
Umbilical hernias	170	7.7
White line hernias	73	3.3
Femoral hernias	54	2.4
Epigastric hernias	15	0.7
Spiegel hernias	12	0.5
Total	2216	100

Table 1: Distribution of topographic types of abdominal wall hernias

2.2 Sociodemographic characteristics

2.2.1 Sex

The male sex predominated in our series with 925 cases (90.0%) for 99 women (10.0%). The male/female sex ratio was 9.3.

2.2.2 Age

The predominant age group was between 20-29 in 230 cases (22.5%). The average age was 45.6 +/- 17.8 years. The age ranges were 18 and 94.

Age groups (years)	Effective	Percentage (%)
[10-19]	28	2.7
[20-29]	230	22.5
[30-39]	180	17.6
[40-49]	133	13
[50-59]	190	18.6
[60-69]	154	15
≥70	109	10.6
Total	1024	100

Table 2: Distribution of patients according to age groups

2.2.3 Occupation

In our series, the patient's profession was specified in 841 cases (82.1%). The category of hard workers (mason, mechanic, farmer, housewife, soldier, dock worker and trader) predominated in 578 cases (56.4%) against 263 cases with an intellectual occupation (pupil, student, teacher, engineer, accountant).

The practice of intense and regular physical activity was found in 391 patients (38.2%). Of these, 233 (22.8%) carried heavy loads (Table 3)

Variable	Effective	Percentage (%)
Occupation		
Docker	30	2.9
Trader	85	8.3
Farmer	103	10.1
Student (School)	55	5.4
Student (University)	89	8.7
Builder	109	10.6
Military	72	7
Mechanic	105	10.3
Household	74	7.2
Teacher	67	6.5
Ingineer	38	3.7

Accounting	14	1.4
Physical activity practiced		
Carrying heavy loads	233	22.8
Sportsmen	158	15.4
Sedentary	633	61.8

Table 3: Distribution of patients by profession and physical activity practiced

3. History

3.1 Distribution according to history

3.1.1 Surgical history

According to table 4, a surgical history was found in 123 of our patients (12.1%). This was the cure of an inguinal hernia in 83 patients (8.1%). The remaining surgical history 40 cases (4%) was dominated by appendectomy 13 cases (1.3%).

Surgical history	Effective	Pourcentages (%)
Cures of inguinal hernias	**83**	**8.1**
Other types of surgeries	**40**	**4**
Appendicectomy	13	1.3
Prostatic adenomectomy	7	0.7
Caesarean	3	0.3
Arteriovenous fistula (AVF)	3	0.3
Umbilical hernia cure	1	0.1
Hydrocele cure	2	0.2
Hemorrhoidectomy	2	0.2
Heart valve replacement	1	0.1
Radical prostatectomy	2	0.2
Hémicolectomy	1	0.1
Hysterectomy	1	0.1
Extraction of a bladder stone	1	0.1
Orchipexy	1	0.1
Left arm osteosynthesis	1	0.1
Left varicocelectomy	1	0.1
Total	**123**	**12.1**

Table 4: distribution of patients according to surgical history

3.1.2 Medical history

Table 5 shows that in our series, 232 patients (22.8%) presented as a medical history dominated by arterial hypertension 101 cases (9.9%).

In addition, prostate pathologies 56 cases (5.5%), pulmonary diseases 22 cases (2.2%) and 3 cases (0.3%) of ascites were present.

Diseases	Effects	Percentages (%)
Prostatic pathologies	**56**	**5.5**
Benign prostatic hyperthrophy	48	4.7
Prostate cancer	8	0.8
Lung cancer	**22**	**2.2**
Asthma	14	1.4
Tuberculosis	5	0.5
Chronic bronchitis	3	0.3
Ascites	**3**	**0.3**
Comorbidities	**151**	**14.8**
High blood pressure	101	9.9
Diabetes	33	3.2
AIDS	12	1.2
Viral hepatitis	5	0.5
Total	**232**	**22.8**

Table 5: Distribution of patients according to medical history

3.1.3 Other history

Alcohol was consumed by 83 patients (8.1%) and tobacco by 61 patients (6.0%). Our patients were postmenopausal in 58 cases (58.6%) and multiparous in 85 cases (85.8%). We found in our series 59 cases (5.8%) of histories of familial hernias.

Variables	Effectifs	Pourcentages (%)
Toxicological history		
Tabacco	61	6
Alcohol	83	8.1
Gynecological history		
Menopause		
Yes	58	58.6
No	41	41.4
Parity		
Nulliparous	10	10.1
Primiparous	4	4
Multiparous	85	85.9
Family history		
Hernias	**59**	**5.8**
High blood pressure	34	3.3
Diabetes	14	1.4

Table 6: Toxicological, gynecological and familial histories

3.2 Distribution of primary and recurrent hernias

We observed 950 cases of primary hernias and the rest, so 74 cases (7%) of hernial recurrence

3.2.1 Clinic anamnestic characteristics

In our series, most patients (673 cases; 65.7%) were aware of their hernia; 192 patients (18.8%) discovered it incidentally and 159 cases (15.5%) presented with a picture of hernia complications (Ttable 7). The mean duration of the hernia was specified in 793 cases (77.5%) and was 5.31 months with extremes of one week and 8 years. Patients (737 cases; 72.0%) had mostly consulted within 15 months (table 7). As it shown in the table below, more than half of our patients had developed a hernia or recurrence after exertion (741 cases; 72.4%). The onset of the hernia was spontaneous in 283 cases (27.6%).

Variables	Effective	Percentages (%)
Circumtances of findings		
Fortuitous	192	18.8
Known hernia	673	65.7
Hernia complications	159	15.5
Total	1024	100
Duration of hernia (months)		
<15	737	72
[15-29]	40	3.9
[30-44]	9	0.9
[45-59]	3	0.3
[60-74]	3	0.3
≥75	1	0.1
Total	793	77.5
Mode of occurrence of the hernia		
Spontaneous onset (without effort)	283	27.6
Occured after an effort	741	72.4

Table 7: Anamnestic data of hermia

3.3 Clinical diagnosis

3.3.1 Distribution of simple and complicated hernias

The hernia was simple in 865 cases (84.0%) and complicated in 159 cases (16.0%).

3.3.2 Functional signs

As shown in table 8, Swelling was the main reason for consultation of patients presenting with a simple hernia (810 cases; 93.7%). It was inguinal in 67.2% and inguinoscrotal in 26.5%. Inguinoscrotal pain was the main reason for consulting patients with complicated hernias in our series (85 cases; 53.4%).

Abdominal pain was the only sign associated with the simple hernias found in our series (5 cases; 0.6%). Signs associated with complicated hernias consisted of 24 cases (15.1%) of abdominal pain, 18 cases (11.3%) of vomiting, 11 cases (6.9%) of nausea, 10 cases (6.3%)) cessation of materials and gas and 6 cases (3.8%) of fever.

Variables	Simples hernias		Complicated hernias		
Reason of consultation	**n**	**(%)**	**n**	**(%)**	**P value**
Pain					
Inguinal	481	55.6	72	45.3	
Inguinoscotal	179	20.7	85	53.4	
Total	660	76.3	157	98.7	0.0001
Swelling					
Inguinal	581	67.2	73	45.9	
Inguinoscrotal	229	26.5	84	52.8	
Total	810	93.7	157	98.7	
Associated signs					
Abdominal pain	5	0.6	24	15.1	
Fever	-	-	6	3.8	
Nausea	-	-	11	6.9	0.0805
Vomiting	-	-	18	11.3	
Stop of materials and gases	-	-	10	6.3	
Total	5	-	69	43.4	

Table 8. Distribution according to functional findings

3.4 Physical signs

Patients with simple hernias presented painless swelling in 850 cases (98.3%), reducible (857 cases; 99.1%), mole consistencies (855 cases; 98.8%) and non-inflammatory (851 cases; 98.4%). The abdomen was flexible in 860 cases (99.4%) and the digital rectal examination was normal (611 cases; 70.6%) (Table 9). Complicated hernias were all painful, irreducible in 148 cases (93.1%), of hard or mixed consistency (153 cases; 86.5%) and inflammatory features (157 cases; 98.7%). Palpation of the abdomen recovered in 39 cases (24.5%).

Physical signs	Simples hernias		Complicated hernias		
	n	**(%)**	**n**	**(%)**	**P value**
Sensitivity of wall swelling					
Paintful	15	1.7	159	100	0.0001
Not paintful	850	98.3	0	0	
Réducibility					
Irréducible	8	0.9	148	93.1	
Reducible	857	99.1	11	6.9	0.0001
Spontaneous	780	90.2	10	6.3	
Manual	77	8.9	1	0.6	
Consistency					
Mole	855	98.8	6	3.8	
Tough	7	0.8	134	84.3	0.0001
Mixed	3	0.4	19	2.2	
Skin appearance					
Inflammatory	14	1.6	157	98.7	0.0001
Non-inflammatory	851	98.4	2	1.3	

Palpation of the abdomen					
Flexible	860	99.4	120	75.5	
Defense	10	1.1	39	24.5	0.0001
Rectal touch					
Normal	611	70.6	153	96.2	
Prostate hypertrophy	37	4.3	5	3.1	0.4151
Paintful	1	1.1	0	0	
Not paintful	36	4.2	5	3.1	

Table 9: Distribution of patients according to physical signs

3.5 Topography of hernias

Table 10 shows that, simple hernias were found on the right in 473 cases (53.9%), on the left in 292 cases (33.3%) and bilateral in 112 cases (12.8%). They were inguinal in 645 cases (73.5%) and inguinoscrotal in 232 cases (26.5%).

Complicated hernias were located on the right in 105 cases (65.2%), on the left in 49 cases (30.4%) and bilateral in 7 cases (4.3%). They were inguinal in 72 cases (44.7%) and inguinoscrotal in 89 cases (55.3%).

	Simple hernias		**Complicated hernias**		
Topography	**n**	**(%)**	**n**	**(%)**	**P Value**
RIH	**324**	**36.9**	**40**	**24.8**	
LIH	218	24.9	25	15.5	
BIH	103	11.7	7	4.3	0.0001
RISH	**149**	**17,0**	**65**	**40.4**	
LISH	74	8.4	24	14.9	
BISH	9	1	0	0	
Total	877	100	161	100	

Table 10: Distribution of patients according to the topography of the hernias

RIH: Right inguinal hernia; LIH: Left inguinal hernia; BIH: Bilateral inguinal hernia; RISH: Right inguinoscrotal hernia; LISH: Left inguinoscrotal hernia: BISH: Bilateral inguinal hernia

3.6 Complication

3.6.1 Types and duration

Hernial strangulation was the main complication with 136 cases (85.5%), followed by infatuation 23 cases (14.5%). Strangulation was isolated in 116 cases (73.0%), associated with occlusive syndrome in 9 cases (5.6%), peritoneal irritative syndrome in 7 cases (4.4%) and pyostercoral phlegmon in 4 cases (2.5%). We also found 4 cases of "Richter's lateral pinching" including 1 case associated with peritoneal syndrome and 3 cases with occlusive syndrome (Table 11).

The average duration of the strangulation was 14.4 +/- 20.0 hours with extremes of 2 hours and 5 days.

Complications	Effective	Percentages (%)
Type of complications		
Infatuation	**23**	**14.5**
Strangulation	**136**	**85.5**
Isolated strangulation	116	73
Strangulation + intestinal obstruction	9	5.6
Strangulation+ peritonitis	7	4.4
Strangulation + pyostercoral phlegmon	4	2.5
Total	159	100
Duration of strangulation (hours)		
<10	**99**	**62.3**
[10-19]	25	15.7
[20 à 29]	18	11.3
[40 à 49]	11	6.9
≥50	6	3.8
Total	159	100

Table 11: Types and duration of strangulation

3.7 Risk factors

The dependence was statistically very significant between the occupation and the occurrence of complications during the hernial course with a p< 0.05 (Table 12)

The dependence was very significant between the duration of the course of the hernia and the occurrence of complications with a p < 0.05.

Variables	Simple hernia	Complicated hernias	P value
Profession			
Driver	20	10	
Trader	68	17	
Farmer	74	29	
Student (school)	51	4	
Student (university)	78	11	
Builder	94	15	**0.0001**
Military	69	3	
Mechanic	83	22	
Household	64	10	
Teacher	61	6	
Engineer	36	2	
Accounting	11	3	
Total	709	132	
Duration of onset			
2	620	117	
[15-29]	19	21	
[30-44]	6	3	
[45-59]	1	2	**0.0001**
[60-69]	1	2	

≥75	1	0	
Total	648	145	

Table 12: Association between the profession, the duration of the hernia, and the occurrence of complications

3.8 Paraclinical aspects

According to table 13, the diagnosis of inguinal hernia was clinical in 99.0%. Ten ultrasounds (1.0%) were performed in our study. The indications were diagnostic doubt in obese patients.

Laboratory workup was systematic in all patients and consisted of a complete blood count (CBC), prothrombin level (PT), activated partial thromboplastin time and blood grouping (GS). It revealed hyperleukocytosis in 26 cases (2.5%), anemia (mild, moderate or severe) in 92 cases (9.0%), thrombocytopenia in 32 cases (3.1%), a prothrombin level (PT) low in 3 cases (0.3%) and a high activated partial thromboplastin time in 2 cases (0.2%).

Variables		Effective	Percentage (%)
Imaging			
Inguinal ultrasound		9	0.9
Abdominal ultrasound		1	0.1
Total		10	1
Biological data			
White blood cells			
[4-10]G/L	<4	31	3
	[4-10]	59	5.8
	>4	26	2.5
Hemoglobin			
[12-17]g/dl	<12	92	9
	[12-17]	23	2.2
	>17	1	0.1
Platelets			
[150-400]G/L	<150	32	3.1
	[150-400]	84	8.2
Prothrombin			
>70%	≤70%	3	0.3
	>70%	113	11
Activaed partial thrimboplastin time			
[25-36]s	<25	1	0.1
	[25-36]	113	11
	>36	2	0.2

Table 13: Imaging and Biological Data

3.9 Therapeutic

3.9.1 Non-surgical treatment

Manual reduction (taxis) was performed in 2 (1.2%) of our patients. Step 2 analgesics were used in 65.2% of cases (564) for simple hernias and in 89.9% of cases (157) for complicated hernias. Surgical antibiotic prophylaxis was systematic (Table 14)

Modalities	Hernies simples		Hernies compliquées		
	n	(%)	n	(%)	P value
« Taxis »	**0**	**0**	**2**	**1,2**	0.5749
Pain relievers					
NSAIDs	342	39.5	102	64.1	
Tier 1	564	65.2	143	89.9	0.4478
Tier 2	649	75	157	98.7	
Antibiotics					
Clavulanic acid amoxicillin	348	40.2	17	10.7	
Ampicillin	17	2	2	1.3	0.0001
Ceftriaxone	508	58.7	140	88.1	
Gentamycin	70	8.1	69	43.4	
Metronidazole	2	0.2	8	5	

Table 14: Distribution of non-surgical therapeutic modalities

3.10 Surgical treatment

3.10.1 Therapeutic modalities

The approach was inguinal in 99.9% of cases (864) for simple hernias and in 98.1% of cases (162) of cases for complicated hernias. Spinal anesthesia was performed in 76.1% of cases (659 cases) for simple hernias and in 57.4% of cases (93) for complicated hernias. The use of prosthesis concerned 84 patients (9.7%) with simple hernias and 7 patients (4.4%) with complicated hernias (Table 15)

Modalities	Simple hernias		Complicated hernias		
	n	(%)	n	(%)	P Value
Appoach	**865**	**1000**	**159**	**100**	
Inguinal	864	99.9	156	98.1	
Inguinal converted to median	1	1	0	0	0.0003
First median	0	0	3	1.9	
Type of anesthesia	**866**	**100**	**162**	**100**	
General	195	22.5	66	40.7	
Local	12	1.4	3	1.9	0.0001
Rachi-anesthesia	659	76.1	93	57.4	
Prosthetic treatment	**865**	**100**	**159**	**100**	
Yes	84	9.7	7	4.4	0.0306
No	781	90.3	152	95.6	
Type of prothesis	**84**	**100**	**7**	**100**	
-Polypropylene	75	89.3	1	14.3	0.7716
-Mersilene	9	10.7	6	85.7	

Table 15: Approach, anesthesia

3.10.2 Surgical techniques

According to table 16, simple hernias were mostly operated using the Lichtenstein technique (76 cases; 90.5%). The pre-peritoneal trans-abdominal route (TAPP) was the only laparoscopic technique used (2 cases; 2.4%). Complicated hernias were operated only by the Lichtenstein technique (7 cases).

The most performed non-prosthetic treatment was that of Bassini in 374 cases (47.9%) for simple hernias and in 72 cases (47.4%) for complicated hernias.

Techniques	Simple hernias		Complicated hernias		
	n	(%)	n	(%)	P value
Prosthetic techniques					
Conventional way					
Lichtenstein	76	90.5	7	100	0.4586
Prolene Hernia System	6	7.1	0	0	
Laparoscopic route					
Trans-Abdominal Pre-Peritoneal	2	2.4	0	0	0.5439
Total	84	100	7	100	
Non-Prosthetic techniques					
Bassini	374	47.9	72	47.4	
Mac Vay	54	6.9	4	2.6	0.0001
Shouldice	353	45.2	76	50	
Total	781	100	152	100	

Table 16: Sutgical techniques

3.10.3 Intra-operative findings

Indirect hernias were the most frequent in our series: 574 cases (66.0%) for simple hernias and 123 cases (76.9%) for complicated hernias (Table 17)

NYHUS type IVA was the most common of simple hernias (12 cases; 1.4%) while type IVB dominated the picture of complicated hernias (4 cases; 2.4%).

The small intestine was the main content of the hernial sac in 636 cases (73.5%) for simple hernias and 129 cases (81.1%) for complicated hernias. We also found 14 cases of Claudius Amyand hernias, 2 cases of hernias with ovarian content and 3 cases with bladder content (Table 17)

Variables	Simple hernias		Complicated hernias		
	n	%	n	%	P value
Anatomical type of hernia					
Direct	290	33.3	37	23.1	
Indirect	574	66	123	76.9	0.001
In pants	6	0.7	0	0	
Total	870	100	160	100	
NYHUS classification					
Type IIIA	0	0	1	0.6	
Type IIIB	2	0.2	2	1.3	
Type IVA	11	1.3	2	1.3	0.1309

Type IVB	10	1.2	2	1.3	
Total	23	2.7	7	4.5	
Contents of the hernial sac					
Appendicitis	3	0.3	11	6.9	
Colon	32	3.7	12	7.5	
Omentum	183	21.2	53	33.3	
Small intestine	636	73.5	129	81.1	
Ovairy	2	0.2	0	0	0.0001
Adipose tissue	12	1.4	0	0	
Fallopian tube	1	0.1	0	0	
Bladder	3	0.3	0	0	
Empty	6	0.7	0	0	
Total	878	100	205	100	

Table 17: Surgical findings

3.10.4 Special features of strangulated hernias

As shown in table 18, the dependence was statistically very significant between the duration of the hernias and the condition of the strangled organs with a p< 0.05

The dependence was statistically very significant between the content of complicated hernias and their conditions with a p< 0.05.

Variables	Healthy	Necrotic	P value
Duration of strangulation			
< 10 hours	67	5	
[10-19]	3	18	
[20-29]	0	17	0.0001
[40-49]	3	8	
≥50	0	4	
Total	73	52	
Contents of complicated hernias			
Appendicitis	2	8	
Colon	4	6	
Omentum	33	11	
Small intestine	63	40	
Total	102	65	

Table 18: State of contents of complicated hernias

3.10.5 Treatment of the contents of complicated hernias and hernial recurrences

As represented in table 19, the treatment of the sac contents of complicated hernias consisted of resection / anastomosis in 43 cases (27.0%).

Most recurrent hernias were treated by the Shouldice technique (25 cases; 33.8%), followed by the Bassini technique (23 cases; 31.1%) then by the Lichtenstein technique (20 cases; 27.0%).

Prise en charge	Effects	Percentages
Contents of complicated hernias		
Resection/Anastomosis	43	27
Appendicectomy	11	6.9
Stomie	1	0.6
Total	55	34.5
Hernial recurrences		
Prosthetic techniques		
Lichtenstein	20	27
PHS	1	1.3
Non-Prosthetic techniques		
Bassini	23	31.1
Shouldice	28	37.9
Mac Vay	2	2.7
Total	74	100

Table 19: Treatment of the contents of complicated hernias and hernial recurrences

3.11 Evolution

3.11.1 Suites opératoires

Mortality was zero and morbidity was 1.4% (12 cases) for simple hernias and 6.2% (10 cases) for complicated hernias (table 20).

The mean postoperative hospital stay was 3.42 +/- 1.55 days. The extremes were 1 day and 17 days. Most patients with a simple hernia (545 cases; 63.0%) had a postoperative hospital stay of 2-3 days and those with a complicated hernia (91 cases; 57.2%) between 4-5 days.

Variables	Simple hernias		Complicated hernias		
	n	(%)	n	(%)	P value
Operative suites					
Simple	853	98.6	149	93.8	
Sctotal hematomas	10	1.2	5	3.1	0.0001
Wall infections	2	0.2	5	3.1	
Total	865	100	159	100	
Duration of hospitalization					
≤1	26	3	3	1.9	
[2-3]	545	63	32	20.1	
[4-5]	248	28.7	91	57.2	
[6-7]	39	4.5	25	15.7	0.0001
[8-9]	5	0.6	2	1.3	

[10-11]	1	0.1	2	1.3	
≥12	1	0.1	4	2.5	
Total	865	100	159	100	

Table 20: Distribution according to Operative suites and duration of hospitalization

3.11.2 Factors associated with early postoperative complications

	Wall Infections		**Scrotal hematomas**		
	n	**%**	**n**	**%**	**P value**
Sex					
Female	2	0.2	0	0.0	**0.0299**
Male	5	0.5	15	1.5	
Duration of hospitalization					
[2-3]	0	0	2	0.2	
[4-5]	0	0	4	0.4	
[6-7]	1	0.1	6	0.6	**0.0488**
[8-9]	1	0.1	1	0.1	
[10-11]	3	0.3	0	0	
≥12	2	0.2	2	0.2	
Surgical techniques					
Bassini	4	0.4	7	0.7	
Shouldice	3	0.3	7	0.7	0.654
Mac Vay	0	0	1	0.1	
Age groups					
[20-29]	1	0.1	1	0.1	
[40-49]	2	0.2	2	0.2	
[50-59]	2	0.2	5	0.5	0.563
[60-69]	0	0	4	0.4	
≥70	2	0	3	0.3	

The factors associated with early postoperative complications were gender and length of hospital stay of patients with respective "P" values of 0.0299 and 0.0488

4. Discussion

In our study, inguinal hernia was the most common abdominal wall hernia in 85.4% of cases. It accounted for 97.2% of groin hernias. This pathology is also frequently encountered in developed countries, particularly in the USA, where it accounts for 75% of abdominal hernias and more than 90% of groin hernias [3]. In Africa, similar results were found by Halidou in 2008 in Niger (75.7%) and by Olroy-Togbé et al in 2010 in Benin (79%) [7, 14]. This predominance could be explained by the high frequency of inguinal hernias in men; the woman developing more femoral hernias.

The majority of patients in our series were male (90%) with a sex ratio of 9.3. This result is consistent with that of Drissa et al 2015 in Mali who found a sex ratio of 9.7 and that of Kammo 2019 in Cameroon who found a male predominance of 89% [2, 16]. To explain this male predominance, some authors have mentioned an anatomical difference between the two sexes: in men the inguinal canal is crossed by the cord which makes it fragile, which is not the case in women whose inguinal canal contains only the round ligament [8]. In addition, abdominal hyperpressure factors promoting

the development of inguinal hernia tend to be more present in men (intense physical activity, prostatism, chronic obstructive pulmonary disease). Inguinal hernia is pathology in active young adults and in the elderly people.

The most represented age groups in our series were between 20-29 and 50-59 years with an average age of 45.6 +/- 17.8 years. This result corroborates with that of Sanogo 2018 in Mali who found an average age of 43.19 years [8]. On the other hand, Ngowe et al in Cameroon in 2005 found a higher mean age of 60 years as well as Konaté et al 2010 in Senegal (50.5 years) and Ouarhman 2015 in Morocco (49.7 years) [4,6,14]. The fragility of the anatomical structures with age explains the occurrence of hernias in the elderly. Exercising in activities requiring physical effort is implicated in the genesis of hernia in young adults.

The socio-professional statuses were very varied and the category of hard workers (masons, mechanics, farmers, etc.) was dominant in 56.4% of cases. This result is consistent with that of Diop et al in Senegal and that of Rouet et al in Cameroon in 2017, who found a predominance of forced laborers in 67% and 72% of cases respectively [12,14]. The socio-economic conditions of the city of Douala would push young people to do work requiring repeated intense physical efforts, eventually presenting hernias. Which could explain this predominance in our series.

A surgical history was found in 12.1% of cases. Most (8.1%) were for inguinal hernia repair. This could be explained by the fact that herniorrhaphy is the most performed surgical procedure in Cameroon [14]. A similar finding was made by Rouet et al in 2017 who found 26.8% of cases with a history of inguinal hernia repair [14]. The study by Belhadj et al 2018 in Tunisia found 15.6% of surgical history including 58.4% of inguinal hernias coinciding with our results [14].

Medical history accounted for 22.8% of cases with a predominance of arterial hypertension 9.9%. It is a comorbidity that Bita et al presented as a public health problem in the city of Douala with a prevalence of 24.8% [14]. Which could explain this predominance in our patients. The other antecedents mainly found the causes of abdominal hyperpressure (benign prostatic hypertrophy, prostate cancer, asthma, tuberculosis, chronic bronchitis and ascites) also found by some authors [6-8].

In our study, alcohol was the most consumed toxicant (83 cases; 8.1%). However, the tobacco consumed by 61 patients (6.0%) in our series is recognized by some authors as a factor modifying the metabolism of connective tissue in the inguino-femoral region, hence its implication in the pathogenicity of the hernia [96, 107 , 149]. Fatima-Zahara 2018 and Ouaaziz 2019 in Morocco respectively found 12.06% and 36.36% of smoking cases, showing its role in the occurrence of hernia [6, 7].

Our patients were postmenopausal in 58 cases (58.6%) and multiparous in 85 cases (85.9%). This result explains the occurrence of the hernia in our patients. Some authors have implicated these two factors in the genesis of the hernia by weakening of the musculo-aponeurotic structure of the inguinal region in women [21, 22]. The work of Belhadj et al 2018 in Tunisia found 1.1% of multiparas [3]. A history of familial inguinal hernias was found in 5.8% of cases. To explain this hereditary link, researchers recently found four loci susceptible to inguinal hernias that appear to be involved in connective tissue homeostasis [23-29].

In our study, most hernias were primary (93%). Recurrent hernias represented 7% of cases. This recurrence rate could be attributed to the defects of the patients, to the weakness of the wall and to the poor workmanship or choice of the surgical technique. Similar results were found by Ouarhman 2015 in Morocco (91.6%; 8.4%) [30], Belhadj 2018 in Tunisia (95%; 5%) [31] and by Taouagh 2013 in Algeria [32-

38].

Most of the patients had consulted within 15 months (72.0%) of disease progression. This result is different from that found by Dodiyi-manuel et al in 2018 in Nigeria [39] where the majority of patients (40.2%) had consulted after 5 years of progress. They attributed the delay in consultation to the lack of education of the studied population. Physical strain was linked in 64.2% of cases to the occurrence of the hernia. The onset was spontaneous in 27.6% of cases. This result is different from that of Taouagh 2013 in Algeria who found a spontaneous occurrence of hernias in 46.5% and related to exertion in 29.9% [40]. This difference could be explained in our study by the predominance of hard workers.

Simple hernias were the most common (84%) and complicated hernias 16%. This result is consistent with that of Dao 2011 in Mali who found 85.7% of simple hernias and 14.3% of complicated hernias [41]. Studies by Ngowe et al 2005 in Cameroon found 78.6% of simple hernias and 21.4% of complicated hernias [42] approaching our results. On the other hand, Drissa et al 2015 in Mali found 39.6% of complicated hernias [42]. This difference could be explained by the fact that in this last study the complicated hernias involved in addition to infatuation and strangulation; the recidivist.

Concerning simple hernias, swelling was the main reason for consultation (79.1%). It was inguinal in 56.7% and inguinoscrotal in 22.4%. This result is close to that of Sanogo 2018 in Mali, who found swelling in 72.62% of patients [43]. On the other hand, Diop et al 2017 in Senegal found a higher proportion of inguinoscrotal swelling (53%) than inguinal (47%) [27]. This difference could be explained by the much earlier consultation time in our series, resulting in less frequent progression to inguinoscrotal hernias. There are rarely any signs associated with simple hernias. In our series only 5 cases (0.5%) of abdominal pain were found. This could be related to the presence during the diagnosis of other pathologies causing abdominal pain.

A physical exam is the best way to diagnose inguinal hernias. In our series, it found swelling that was painless (83.0%), reducible (83.7%), of mole consistency (83.5%) and non-inflammatory (83.1%). The abdomen was flexible (84.0%) and the digital rectal examination was normal (59.7%). Other authors have found similar results which are consistent with the literature [8, 12]. The right side was most affected at 53.9%, the left side at 33.3% and the hernia was bilateral in 12.8% of cases; this is comparable to the study made by Ouarhman 2015 in Morocco where the hernia was located on the right in 49.2% of cases, on the left in 36.9% and was bilateral in 13.8% [41]. This upright predominance has no explanation in the literature. However, the appearance of a hernia on this side may be the consequence of weakening of the wall following a lateral laparotomy, in particular the Mc Burney incision at the origin of a nerve section of the wall. In contrast, in congenital hernias, this is probably due to the delay in migration of the right testis from the left testis through the inguinal canal [44]. Inguinal hernias (73.5%) were more common than inguinoscrotal hernias (26.5%). On the other hand, a study made by Diop et al in 2017 in Senegal found 47% inguinal hernias and 53% inguinoscrotal hernias [27]. In this study, patients tended to consult late. This explains the high margin of inguino-scrotal hernia found.

For complicated hernias, inguinoscrotal pain was the main symptom of complicated hernias with 85 cases (53.4%). This could be due to the late consultations of our patients thus leaving the hernia to progress to the inguinoscrotal stage. This is consistent with the study made by Harouna et al in 2000 in Niger [12]. The signs associated with this emergency picture included 15.1% abdominal pain, 11.3% vomiting, 6.9% nausea, 6.3% stopping of materials and gas and 3.8% of fever. These signs were related to the different types of strangulations found in our series. Some authors have found similar results [12, 14, 15]. The physical examination found all painful swelling, irreducible

(93.1%), of hard or mixed consistency (86.5%), of inflammatory appearance (98.7%) with defense on palpation of the abdomen (24.5%). These features were for the most part essential to the diagnosis of complicated hernias. Dao 2011 in Mali also found painful, hard and irreducible swelling in 83.1% [15] that came close to our study. The right side was most affected at 65.2%, the left side at 30.4% and the hernia was bilateral in 4.3%. These results are similar to those of Manara Qoreichi 2010 in Morocco, who found 69% of hernias on the right, 29% on the left and 2% bilateral [1]. This right predominance could have the same explanation as that of simple hernias. Complicated hernias were predominantly inguinoscrotal (55.3%) and were inguinal in 44.7% of cases. Many factors contribute to this: age of the patient, repeated pushing efforts, late consultation. Patients do not consult early because of socioeconomic difficulties, their ignorance and also their fear of surgery. Manar Qoreichi 2010 in Morocco also found this inguinoscrotal predominance [2]. Hernial constriction was the main complication at 85.5%. It was isolated in 73.0% of cases; associated with occlusive syndrome in 5.6%; to peritoneal syndrome in 4.4% and to pyostercoral phlegmon in 2.5% of cases. This result is consistent with that of Manar Qoreichi 2010 in Morocco [12]. On the other hand, according to a study made by Harouna et al in 2000 in Niger, 29.4% of strangulations were isolated; 44.1% associated with an occlusive syndrome; 8.8% to peritoneal syndrome and 11.8 to pyostercoral phlegmon [12]. In this study, the mean duration of strangulation was longer than that of our series. In addition, we found in our series 4 cases of "Richter's lateral pinching" including 1 case associated with peritoneal syndrome and 3 cases with occlusive syndrome. This result is close to the study made by Tsopmene et al in 2017 reporting two cases of Richter's hernias in the Baka pygmy population of eastern Cameroon [14]. The time between onset of symptoms of strangulation and admission to hospital was an average of 14.4 hours with extremes of 2 hours and 5 days. This duration varied according to the African series [12, 14, 15]. It could be a function of the low socioeconomic level of the populations. In our series, complicated hernias were more frequently found in growers (29 cases). Nde et al in 2015 in Cameroon found that farmers were poorly aware of complications, had less access to health care and therefore were more prone to complications coinciding with our results [17]. A significant difference was observed between the duration of the hernias and the occurrence of complications (infatuation, strangulation). This difference was also found between the profession of the patients and the said complications with a $p = 0.0001$. On the other hand, no significant difference was observed between age, sex and the occurrence of complications during the course of hernias.

The diagnosis of inguinal hernias was clinical. However, 10 ultrasounds including 9 inguinal and one abdominal were performed in case of doubtful diagnosis or in the assessment of the course of the strangulation. This result is similar to the 5 ultrasounds performed in the study by Harouna et al in 2000 in Niger [12]. Ultrasound scans performed as a diagnostic supplement were sufficient to postpone the diagnosis, which explains our results. The minimal biological assessment in our patients revealed hyperleukocytosis in 2.5% of cases, anemia (mild, moderate or severe) in 9.0% of cases, thrombocytopenia in 3.1% of cases, a prothrombin level (PT) low in 0.3% of cases and a high activated partial thromboplastin time in 0.2% of cases.

Concerning the treatment, an attempt at manual reduction is authorized to carry out gently, if necessary after an injection of diazepam, with the guarantee of operating the patient not later than the next day. Its goal is to turn emergency into fixed surgery. We only found 2 cases (0.2%) in our series. This could be explained in our context by the fact that the patient underestimates the time to evolution, by the uncertainty for the surgeon to operate the next day and

by the random conditions of surveillance of the patient. Broad-spectrum antibiotic prophylaxis was systematic in our series. This could be explained by the sometimes questionable postoperative hygienic conditions.

For the treatment of simple hernias, spinal anesthesia was the most common type of anesthesia 76.1%. This was justified by the advantages offered by this method, both technical and economical. The study by Rouet et al in 2017 in Cameroon, on the other hand, found the predominant practice of local anesthesia at 63% [42]. This was attributed to the fact that the study was conducted during a health campaign and the patients were treated on an outpatient basis. The use of prostheses concerned 84 patients (9.7%). This low proportion could be explained by the high cost of prostheses and the limited financial resources of our patients. The most common type of prosthesis was polypropylene in 75 cases (8.7%). These data agree with the literature [11]. The Lichtenstein technique was the most used with 74 cases (8.6%). The study carried out by Ngowe et al in 2005 in Cameroon, on the other hand, reported 14 cases of inguinal hernias operated by this technique [4]. This study was carried out in a single hospital structure unlike ours. Preperitoneal trans-abdominal intervention was the only laparoscopic technique used (2 cases; 0.2%). Our results are similar to those of Nana et al in 2016 in Cameroon who reported 9 cases of inguinal hernias operated by the TAPP route and none by the PET route [19]. This could be explained by the fact that the TAPP route is easier to learn, offers excellent visibility of the entire abdominopelvic cavity, the hernial areas and anatomical elements of the pre-peritoneal space, provides a wide workspace also allowing a bilateral cure. During our study, the raffia technique most used for the treatment of simple hernias was the Bassini technique in 47.9% of cases. The choice of this technique could be explained by its simplicity and the speed of its realization. External or indirect oblique hernias are the most frequent: 65% of hernias in adult men in Europe [30]. In our series they represented 65.7% of cases. This result is consistent with that of Atah et al in 2016 in Cameroon who found a predominance of indirect hernias at 54.9% [14]. However, pantal hernia: a rare type of hernia combining both direct and indirect hernia was found in 6 cases (0.7%). A case had also been reported in a woman by Choudhari et al 2018 in India [5]. Only 22 cases of hernias were classified as intraoperative. NYHUS type IVA was most common in 12 cases (1.4%). Diop et al 2017 in Senegal, on the other hand, found a predominance of type IIIB in 194 cases (72.6%) [17]. This difference could be attributed to the fact that surgeons do not take care to classify all hernias treated intraoperatively in our context.

Concerning complicated hernias, spinal anesthesia was the most performed in 57.4% of cases. This type of anesthesia is considered to be the best in the literature. Indeed, it avoids the drawbacks of general anesthesia while providing good operating comfort [16]. The prosthetic treatment concerned a total of 7 patients in our series. The only technique used was that of Lichtenstein. This could be explained by the septic risk presented by the prosthetic material in the event of incarceration or strangulation against indicating these techniques in the event of intestinal resection. Complicated hernias, like simple hernias, were mainly treated by the Bassini technique in 47.4% of cases. This technique is easy to learn and perform, justifying its predominance in our context. Some authors have found similar results [12, 14, 15]. Indirect hernias were the most frequent with a rate of 82.4%. NYHUS type IVB was the most represented with 4 cases (2.4%). The contents of the hernial sac were predominantly slender in 81.6% of cases. Management of the contents of complicated hernias consisted the most of resection, anastomosis in 43 cases (27.0%). An appendectomy was performed in 11 cases (6.9%). This result is corroborated by that of Harouna et al in 2000 in Niger who found in 17 patients a resection made and in 5 patients an appendectomy [12].

Most of the recurrent hernias were treated by the Shouldice technique (28 cases; 37.9%). This is due to the fact that the Lichtenstein technique, which is the one recommended, is not easily accessible by our populations. However, this result is different from the study carried out by Konaté et al in 2010 in Senegal where all patients who presented with a recurrent hernia received treatment according to Lichtenstein [6]. This study was only carried out in a referral hospital unlike ours.

Mortality was zero and morbidity was 1.4% (12 cases) for simple hernias and 6.2% (10 cases) for complicated hernias. The mean length of postoperative hospital stay of patients was 3.4 days. These results are similar to those of Haoucine et al 2018 in Tunisia who found a morbidity of 5% [14]. Analysis of the postoperative course revealed certain factors associated with early postoperative complications. It was about gender and length of hospital stay. These data are consistent with the literature [8].

5. Conclusion

Inguinal hernia was the most common of the abdominal wall hernias. It appeared to be a pathology of the active young adult and the elderly. It was predominant in men and especially found in people in the labor force. The diagnosis of inguinal hernia was essentially clinical. Hernial strangulation was the most serious complication that could lead to intestinal necrosis. The factors identified in relation to the occurrence of complications (infatuation and strangulation) were the duration of the hernias and the occupation of the patients. Pain and swelling were the most consistent functional signs. The predominance was straight and the type most found was indirect inguinal hernia. Ultrasound was the only imaging test performed and its indication was diagnostic doubt in the obese patient. Herniorrhaphy is the most widely used surgical treatment, especially the Bassini technique. The Lichtenstein technique is the most widely used prosthetic treatment. Laparoscopic treatments are rare and are represented by the Trans-abdominal pre-peritoneal route (TAPP). Mortality was zero and morbidity was 1.4% for simple hernias and 6.2% for complicated hernias. The factors associated with this morbidity were: gender and length of hospital stay.

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